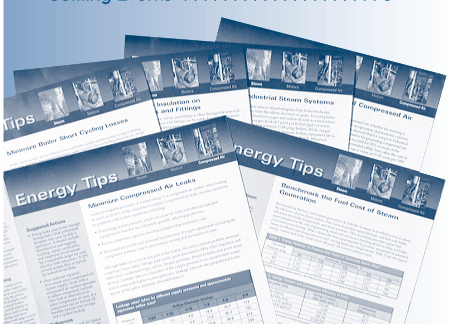
A BestPractices PUBLICATION ON IMPROVING INDUSTRIAL ENERGY EFFICIENCY

ENERGY MATTERS

March/April 2001

ISSUE FOCUS:
System Integration

IN THIS ISSUE



New BestPractices Energy Tip Sheets, see page 7.

Editor's Note: The Motor System supplement scheduled for this issue will appear in a future issue.

OFFICE OF INDUSTRIAL TECHNOLOGIES •
U.S. DEPARTMENT OF ENERGY

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DOE's 4th Expo Highlights Global Competition and Industries of the Future

On February 19-21, more than 100 exhibitors and 1200 industry representatives attended DOE's 4th Industrial Energy Efficiency Symposium and Exposition in Washington, DC. The symposium focused on major trends, opportunities, needs, and issues affecting Industries of the Future—the nine basic, energy-intensive industries that supply more than 90% of our economy's needs for materials.

The Office of Industrial Technologies' (OIT) Industries of the Future (IOF) initiative creates partnerships between industry, government, and supporting laboratories and institutions to accelerate technology research, development, and deployment. BestPractices supports these industries with tools and resources to enhance efficiency and productivity.

Keynote Speakers Share Insights

Expo attendees heard two keynote speakers, who shared international and U.S. perspectives. Eamonn Fingleton, a Tokyo-based author and former editor for *The Financial Times* and *Forbes,* spoke on the subject of his book, *In Praise of Hard Industries; Why Manufacturing, Not the Information Economy, Is the Key to Future Prosperity.* Senator Jay Rockefeller, of West Virginia, spoke of the struggles facing industries in his state, including unenforced trade laws.

Outstanding Individual and Companies Recognized

One of the Expo highlights was OIT's presentation of awards to outstanding organizations and individuals. Awardees were recognized for their energy management achievements, efforts to advance the goals of IOF partnerships, or exceptional technological advances.

OIT awarded Plant-of-the-Year to USX Corporation for its commitment to continuous improvement throughout its operations. The company's Mon-Valley Works, which includes the Edgar Thomson Plant in Brad-

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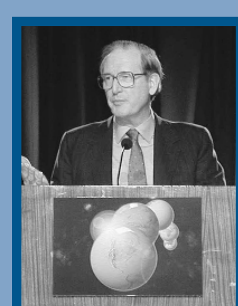

Above: Author Eamonn Fingelton presented ideas on the future of manufacturing and the economy. Right: Senator Jay Rockefeller gave his perspective on the issues facing industries in West Virginia.

Above: Richard McCormack, publisher of* Manufacturing News, *leads the Lean Manufacturing session at OIT's Expo 4. (See sidebar, page 2.)

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COMMENTS?

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DOE's 4th Expo
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dock, Pennsylvania, and the Irvin Plant in West Mifflin, Pennsylvania, have made significant investments in advanced technologies that will increase productivity, while decreasing overall energy use and the impact on the environment.

Among the improvements at these plants were compressed air and steam efficiency projects that employed BestPractices tools and produced exceptional energy savings. (Read a summary about the Edgar Thomson Plant's efforts in the January/February issue of *Energy Matters at* **www.oit.doe.gov/bestpractices/explore_library/energy_matters.shtml.** Or access a case study at **www.oit.doe.gov/bestpractices/explore_library.**)

The OIT Partner-of-the-Year award went to Dr. Carl Irwin, Director of Market Enhancement and Program Development for the National Research Center for Coal and Energy at West Virginia University, in Morgantown. Dr. Irwin has shown outstanding leadership in developing and promoting the State IOF Program in West Virginia.

The OIT Technology-of-the-Year was polylactic acid polymers—a project co-partnered by Cargill Dow and the National Renewable Energy Laboratory. These polymers are biodegradable and produced from sugar, a renewable resource.

Sessions Focus on New Business Strategies

The symposium sessions were organized into four major "tracks": Manufacturing Megatrends, Technology and Environment, Global Markets and Investment Potential, and Human Resources. Each track focused on helping industries make better use of advanced technologies and other resources to gain a competitive edge.

BestPractices Cyber Tools

At the OIT Cyber Café, Expo attendees sampled many of the BestPractices software tools that can help plants save money through proper assessment, selection, and operation of equipment. BestPractices technical experts demonstrated how the Pumping System Assessment Tool, MotorMaster+, 3E Plus Insulation Thickness Tool, the Steam System Scoping Tool, and AirMaster can help improve plant efficiency and the bottom line.

OIT's Expo gave participants opportunities to survey the exhibit hall, network among industry peers, explore potential partnership opportunities, and learn about the global challenges facing the nation's key industries.

To learn about partnerships through OIT, go to the OIT Web site at **www.oit.doe.gov**. To learn about the tools and resources available thorough BestPractices, go to the BestPractices Web site at **www.oit.gov/bestpractices/**.

LEAN MANUFACTURING SESSION ECHOES BESTPRACTICES GOALS

The BestPractices initiative provides technical assistance to help companies boost productivity by reducing or avoiding the waste of energy and other resources. Lean manufacturing, defined as cutting all waste and increasing customer value, is a business philosophy that merges well with BestPractices objectives. It was appropriate then, that one of the sessions presented at the 4th Industrial Energy Efficiency Expo focused on this topic.

Robert Emiliani, director of the Center for Lean Business Management and one of the session panelists, described waste as an activity or output that adds cost but does not add value for the customer. The lean management philosophy, he maintained, can be applied at all levels throughout an organization and not just to the manufacturing portion of a business.

Ken Kreafle, general manager for Quality Control/Quality Engineering, Toyota Manufacturing-Kentucky, was another panelist. He stated that the Toyota Production System focuses on people, cooperation, company-wide teamwork (as opposed to competitive teams within a company), and process (as opposed to results).

Finally, David Squier, former CEO of Howmet International, described how his company employed lean management techniques, and between 1992 and 1999, increased productivity by 40%, quality yield by 37%, and on-time delivery by 78%.

If you would like to learn about tools that can help your company reduce energy use and improve productivity, log on to the BestPractices Web site at ***www.oit.doe.gov/bestpractices/****.*

Guest Column

What's Energy Worth?—Assessing Marginal Energy Costs

By Alan Karp, Manager of Business Development, Veritech, Inc., Sterling, VA

What's energy worth? The answer to this question is prerequisite to any meaningful energy analysis. Simplistic or faulty assumptions about the value of steam and power will lead to inaccurate assessments of the costs and benefits associated with proposed operating changes or capital projects. Conversely, proper understanding of marginal steam and power costs can pinpoint system inefficiencies and facilitate the identification of economically attractive strategies for reducing energy costs.

A steam system model can be an effective tool for predicting energy costs, particularly when there are many variables to consider. The first step is to take a look at which factors affect energy costs.

Examining Energy Cost Variables

To start with, energy costs are not fixed over time. This point may need little reinforcement given the recent natural gas price escalations and the historical volatility of crude oil prices. However, even during periods of stable oil and gas prices, a single number often cannot satisfactorily represent the cost of power or steam consumed by an industrial plant.

Seasonal, time-of-day, and other time and use-related cost variations are common to natural gas contracts and electric power rate schedules. Such price variations may be significant enough to warrant time averaging of several operating scenarios to more accurately assess energy cost impacts.

Energy cost analyses also can be significantly influenced by site-specific and use-specific factors that affect the cost of supplying fuel, steam, and power to the plant.

For example, the cost of producing steam in a boiler will vary with the specific boiler's efficiency—which, in turn, will vary as boiler load changes. Where boilers are capable of using a variety of purchased and/or plant-generated fuels, steam costs will also vary depending on the fuel being used.

Complex Systems, Complex Energy Values

Marginal energy costs are particularly complex at industrial sites that have:

- Multiple, interconnected steam pressure levels
- Motor and turbine options for supplying shaft power
- Different categories of steam users.

The latter may include "live steam users," which consume steam but do not return condensate to the system, and heating steam users, which extract energy from the steam via heat exchangers or heating coils, but permit cost-saving condensate recovery.

The figure below illustrates the interactions of steam and power costs for three common scenarios:

- Power is generated by backpressure turbines, with all exhaust steam being used by the process. (Path 1)
- Power is generated by backpressure turbines, but all exhaust steam is vented. (Path 2)
- Power is generated by backpressure and condensing turbines, with all steam ultimately taken to condensing. (Path 3)

The figure emphasizes the fact that the cost of generating power (or shaftwork) and supplying steam at different pressure levels is highly path-dependent. That is, the cost will vary appreciably depending on how the steam gets from where it is generated to where it is used.

For example, medium-pressure steam that is produced via letdown from the high-pressure header will bear the cost of high-pressure steam generation. Medium-pressure steam that is exhausted from a steam turbine, however, will be less costly to the ultimate steam user because of the economic credit associated with the generation of shaft power.

Although the relative costs given are strictly illustrative and vary for each set of circumstances, they highlight the dramatic differences in energy costs that can coexist at many industrial sites.

As shown, power produced by backpressure turbines can be very competitive with purchased power—*provided* that the exhaust steam is used by the process. Conversely, such power is prohibitively costly if the exhaust steam is vented.

Purchased power is predominantly produced in large, condensing power plants. Accordingly, condensing power generation inside the plant competes directly with the electric utility on an operating cost basis.

A Model for Assessing Costs

Sorting out the complexities of steam and power values in such systems is best

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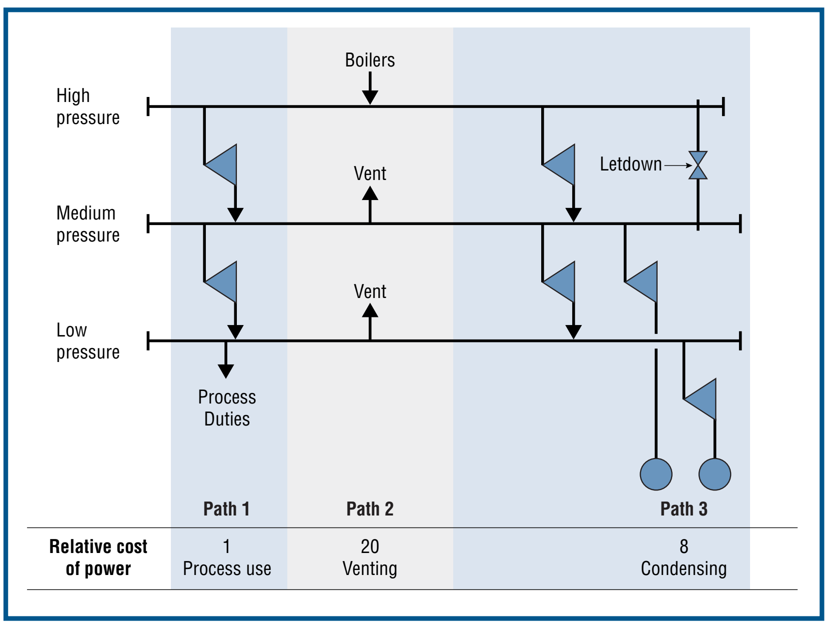


Steam and power costs for three scenarios (Paths 1, 2, and 3).

Economic Optimization and Advanced Process Control to Improve Methanol Plant Operations

By Reinder de Boer, GE Continental Controls, Inc., Houston, Texas, and Scott Williams and William Rump, Enron Methanol Company, La Porte, Texas

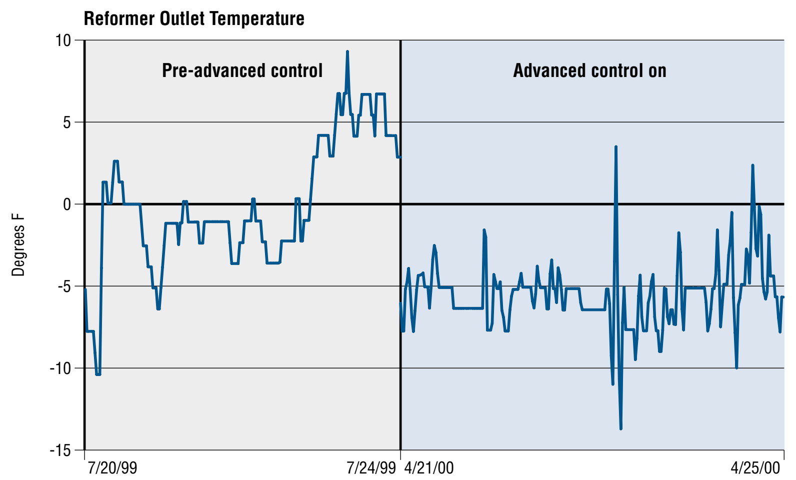


Figure 1. Primary reformer outlet temperature before and after advanced control.

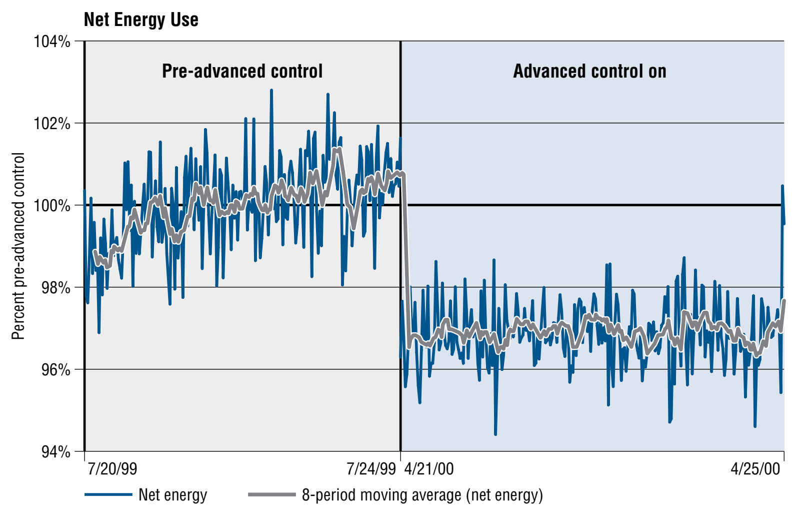


Figure 2. Net energy use in the production of methanol was reduced 2.4% after implementation of advanced process controls.

The Enron Methanol Company, in Pasadena, Texas, produces a methanol product used in gasoline additives and as a solvent for adhesives and finishes. Recently, the company applied an advanced process control system that has significantly contributed to a reduction in the plant's operating costs, including a 2.4% reduction in net energy costs.

The plant's single train design uses a Lurgi synthesis loop, which consists of four major systems: feed gas preparation, reforming, synthesis, and purification. One of the main uses for energy at the plant is to generate steam for the reformers. Another energy use is to operate major equipment, such as compressor turbines and pumps. The heat recovery section of the reformers contributes to the generation of steam. Controlling the steam-to-carbon ratio in the feed and maintaining the steam header pressures can reduce the steam use per unit of methanol produced.

In addition to energy for steam generation, the reformers also consume a large amount of fuel gas as an energy source. By controlling the temperature profiles in the reformers, this usage can also be reduced.

The Case for Advanced Process Controls

Petrochemical processes, such as those required for methanol production at Enron, are excellent applications for multivariable control and optimization because of several market and operating factors that affect plant operations and profitability. Some of the key factors include:

- Dynamic market supply and demand effects on feedstock (natural gas) and product prices
- Capacity and throughput limitations
- Variability of gas feedstock rates, quality, and composition
- Environmental requirements.

As a result, there is an opportunity to push a plant to its maximum operating capacity and economically optimize operations in the face of constantly varying conditions. The need to optimize operations is even more apparent with roughly 6 million tons of new capacity online in the last 2 years. In addition, impending MTBE legislation poses potential stress on the market. With this in mind, energy reduction and yield improvement are necessities to remain globally competitive. Enron considered these factors and decided to implement an advanced process control and optimization system at this facility.

Process Improvements and Savings

By applying the advanced process control and optimization system, Enron achieved energy savings and productivity improvements in the these areas:

- Steam reforming
- Methanol reaction
- Purification section
- Secondary or autothermal reformers
- Purge and loop control.

As a result, net energy use decreased by 2.4% per gallon of methanol produced. The payback period for the project was 5 months.

(continued on page 5) ▶

Performance Optimization Tips

Liberal Application of a Conservative Principle

By Don Casada, OIT BestPractices Program

A little puzzle: Can you give me some feedback about what Newton's third law of motion has in common with the following items?

1. *The economic model of supply and demand*
2. *Loudspeaker squealing*
3. *The Chernobyl nuclear reactor*
4. *The California electricity crisis*
5. *Wasted energy in industrial plant operations*

Here's a clue: *The answer is in the question.* Let's discuss each item and look for a common thread.

Newton's third law of motion says that: ***For every action, there is an equal and opposite reaction.*** If I push (or pull) on an inanimate object, it pushes (or pulls) back with a reactionary, or balancing force, exactly equal to the one applied.

1. The economic model of supply and demand deals with the interrelationship between supply, demand, and price. In a stable market of widgets, supply and demand are matched. Then something happens to create a shortage of widgets, and competition for the scarce resource grows.

We would expect prices to increase enough to cause an initial reduction in demand. But the new, higher price may also attract more suppliers, and prices may reverse. The cycling iterates, but always seeks a balance between the competing forces.

2. Loudspeaker squealing occurs because of problems in location of a microphone and the loudspeaker. The figure on page 6 shows a situation where a microphone is positioned directly under a speaker. A small sound into the microphone will be amplified and sent through the speaker. The higher volume sound will repeat the cycle. The distance between the speaker and the microphone will affect the frequency, but the existence of the closed, self-amplifying loop is the primary cause of the squealing.

3. The Chernobyl nuclear reactor catastrophe was largely the result of a fundamental design flaw. Its reactor core was designed to have a positive power reactivity coefficient[1]. That is, as the nuclear

(continued on page 6) ►

Economic Optimization

continued from page 4

Enron found that the primary reformer contributed to the majority of fuel savings. Implementing balanced firing control between the north and south reformer tube-banks minimized the temperature differences, bringing the entire reformer closer to optimal conversion. This also minimized the potential for damage to catalysts and tubes in the radiant section of the reformers, which can be caused by excessive temperatures.

Figure 1 shows the tighter control of primary reformer outlet temperature. The temperature deviation was reduced from ± 4°F to ± 2°F.

More uniform temperatures also prevent carbon deposition in the reforming tubes. This moderation of conditions increases the lifetime of the reforming tubes, improves methane conversion for a given energy consumption, and allows lower steam-to-carbon ratios. Moreover, the average outlet temperature was reduced by 6°F, resulting in reduced fuel gas use, as shown in Figure 2.

In addition to the financial and energy savings gained by implementing advanced process control strategies, the new system will reduce plant alarms, previously caused by deficient control of and slow response to process excursions. The system achieves this reduction by responding to predicted, future constraint violations, acting continuously to prevent their occurrence.

Potential for Other Applications

Enron's example shows advanced process control and economic optimization have many potential benefits to the methanol industry. Results from similar processes (e.g. ammonia synthesis) have achieved project paybacks of 4 to 7 months. Projected energy savings for methanol plants surveyed range from $750,000 to $1.5 million annually, depending on the nameplate capacity of the plant and raw material prices. In current studies, methanol prices ranging from $0.30 to $0.50/gallon ($100 to $168/ton) have been used. ●

To learn more about this project contact Reinder de Boer, Project Manager, GE Continental Controls by phone at 713-978-4413, or e-mail reinder.deboer@indsys.ge.com.

How Advanced Process Control Technology Works

A multivariable control system simultaneously manipulates more than one variable to achieve a certain goal or set point. A model predictive control system uses algorithms to compute a sequence of manipulated variable adjustments by predicting the future behavior of the process.

Typically, a multivariable control software program can be installed on a personal computer to interface with the field controllers through a supervisory control and data acquisition package. The conventional control system, which may contain an assortment of customized control blocks, is replaced by one centralized computer program that includes the multivariable and model predictive control system.

A successful multivariable control system includes several key functionalities, including:

- *A modular controller structure with nonlinear predictive models and nonlinear multivariable constrained controller optimization*
- *Limits on the movement of adjustable variables*
- *Adaptability with tuning constants and variable scaling and weighting*
- *Economic optimization with instrument failure detection, process-variable filtering health and status checks, and an informative and usable operator interface.*

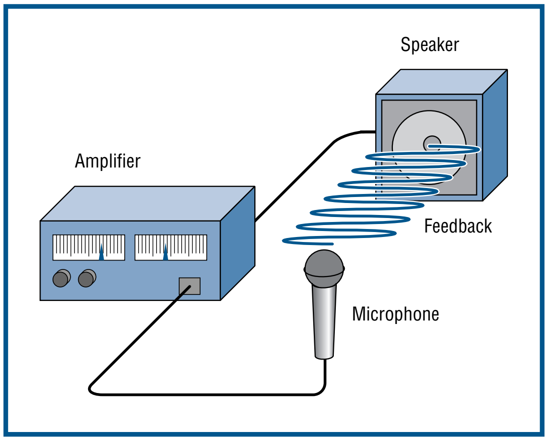
The development of the advanced process control system in this case study was supported by the Gas Research Institute, Chicago, Illinois (now the Gas Technology Institute).

Performance Optimization Tips
continued from page 5

power in the core increased, it tended to cause a further increase. So, once an excursion started, it was self-propagating.

4. The California electricity crisis is a result of several cause and result factors, including:

- A significantly increased demand coincident with minimal new capacity
- Retail price controls for two major utilities (fixed selling prices well below the utility purchase costs)
- Utilities were prohibited from entering into long-term contracts
- Heavy dependence on natural gas generation (and at a time of soaring natural gas prices)
- Independent power producers who weren't being paid.



Speaker and microphone loop.

Feedback on the Puzzle

Before we discuss the fifth item, I'll give you my answer to the puzzle. All the items on the list, like Newton's third law of motion, either have or should have a properly controlling ***feedback*** system.

Essentially all real-world processes require feedback-type control. We continuously rely on feedback from our native senses to control almost everything we do, from brushing our teeth to driving a car.

Negative feedback is implicit in Newton's third law. Forces in nature always seek balance. Likewise, the economic model of supply and demand, which is also based on empirical observation, includes combinations of negative feedback mechanisms that tend to restore balance.

Both the loudspeaker and the Chernobyl reactor are examples of *positive* feedback designs, where an imbalance reinforces itself out of control. Any time a positive feedback dominates, bad things tend to happen because balance is fundamentally lost.

It's interesting that in the physical world, negative feedback is a positive thing, and positive feedback is a negative thing.

As to the California electricity crisis—you are certainly free to draw your own conclusions. But to a remote, casual observer like me, it appears that artificial constraints imposed on time-proven, market-negative feedback mechanisms, such as prices, demand, and supply, are prime factors.

Which leaves us with one last item on our original list:

5. Wasted energy in industrial plant operations, in my experience, involve factors that, somewhat like the California situation, either:

- Inhibit the natural, negative feedback control mechanisms that seek balance, or
- Misdirect the feedback to the result, rather than the source, of the imbalance between supply and demand.

Inhibited feedback

If one end user in the plant gets an *insufficient* supply of plant utilities, such as compressed air, steam, and water—even if only for 10 minutes a month—the utility staff will certainly hear about it. And that's fine—it is negative feedback from the user to the supplier. But if there is *more* pressure or flow rate, the user will take care of that by bypassing or throttling the supply. A direct result is the utility staff operates more equipment than needed for normal operating conditions. But the higher costs that result from meeting the single end user's infrequent need aren't borne solely by that end user, because utility bills are an overall plant burden. Thus, there is inherent minimization of negative feedback from the supplier to the user, resulting in a loss of balance.

However, balance can be encouraged by other mechanisms. First, there is submetering. The closer the energy/cost meter is to the end user, the more likely it is he or she will be held accountable. Second, a review of the plant's entire consumption pattern can identify the "bad actors" in the facility. Both of these approaches help compensate for the missing "equal and opposite force" and can result in more efficient use of resources.

Misdirected feedback

Controlling flow rate by a throttled valve or damper is an example where feedback addresses a supply and demand imbalance at the end of the process. Controlling flow rate with a valve or damper is analogous to:

- Driving a car with the gas pedal "to the metal" and then regulating speed with the brake, or
- Putting on sunglasses in a room where the lights are too bright.

Using a variable speed drive or on/off operation to control flow rate are examples where the imbalance is addressed at the source. They are analogous to our more common methods of controlling speed (gas pedal) and lights (dimmers or switches).

Operating reviews and plant assessments can help identify misdirected feedback. OIT's BestPractices offers prescreening and opportunity scoping tools for different system types, such as pumping and steam. You can find these tools on the BestPractices Web site at **www.oit.doe.gov/bestpractices**.

Feedback Worthy of Emulation

The few natural laws that we have been fortunate enough to decode from empirical observations, like Newton's third law of motion, are cornerstones for our technological energy world. But they have much to teach us in a more liberal sense.

The evidence consistently shows that the designer of the universe has consistently incorporated negative feedback control into its physical and biological operations. And one can't help but to be amazed at how smoothly and efficiently it works. We human designers and operators might be well served to consider the importance of appropriately applying negative feedback if we're interested in working more smoothly and efficiently in our own, more limited scopes of responsibility. ●

E-mail Don Casada at doncasada@icx.net.

[1] All U.S. reactors are required to have a negative power reactivity coefficient, which means their power is self-limiting.

BestPractices Tools

BestPractices Offers More Tips for Energy and Cost Savings

What do small leaks in compressed air system and uninsulated pipes in steam systems have in common? Both of these power system inefficiencies are energy and economic savings opportunities waiting to happen.

The latest in the series of BestPractices Energy Tip Sheets highlight specific actions as well as descriptions of approaches for steam and compressed air system improvements. Impress management by presenting these approaches to improve efficiency and spur cost savings in your facility. These tip sheets present formulas that will allow you to calculate the projected savings and illustrate examples of plant audits and prevention programs. The new measures will guide you to not only improve your plant's efficiency, but also its productivity.

Find seven new tip sheets with specific "how-to" methods including:

- ***Minimize Compressed Air Leaks:*** Compressed air leaks can waste 20%-30% of a compressor's output. Use this tip sheet to learn the importance of a leak prevention program, discover ways to detect leaks, and determine leakage rates according to orifice size. You'll also find an example of a chemical plant that undertook a leak prevention program and its estimated cost-savings.
- ***Install Removable Insulation on Uninsulated Valves and Fittings:*** High-temperature piping or equipment should be insulated to reduce heat loss, reduce emissions, and improve safety. Learn about the importance of insulated pipes in steam systems and how to project the energy savings (Btu/hr) that can be achieved when removable insulated valve covers are applied. You can also calculate the annual fuel and dollar savings that can be achieved with these applications.
- ***Eliminate Inappropriate Uses of Compressed Air:*** Because compressed air generation is an expensive utility, its appropriate use can make a cost-effective difference. Find out which uses of compressed air are inappropriate, and then discover corrective actions or alternatives. This tip sheet presents an example of an automobile assembly plant, describes what plant personnel identified as inappropriate compressed air uses, and discusses the actions taken by this company to improve efficiency.

Order these newly published BestPractices Energy Tip Sheets through the OIT Clearinghouse by calling 800-862-2086, or download them from the BestPractices Web site at **www.oit.doe.gov/bestpractices/explore_library/**. ●

Guest Column

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served by a "full thermodynamic cycle" costing for steam that includes:

- Deaerator steam impacts
- Backpressure turbine expansion impacts
- Nonfuel cost impacts, such as cooling water usage, makeup water and treatment costs, pumping costs, and fixed costs.

Although the costs and interactions of very simple steam and power systems may be readily apparent, such is not the case with many industrial sites where multiple steam generators and users and many operational "degrees of freedom" exist. Analysis of these steam systems requires a model that is easy to use, yet sufficiently rigorous to capture all significant cost factors and system interactions.

Configuring and applying such models in industrial steam systems typically offer significant opportunities for cost savings. Frequent areas of opportunity include the reduction, if not elimination, of steam venting, optimization of available turbine/motor options, and identification of rapid payback projects to further rationalize steam system operation. Proper energy costing is key to identifying appropriate cost-saving measures.

Alan Karp has more than 30 years of experience in industrial process analysis, design, and engineering, including extensive technical and economic evaluation of industrial process heat and power systems. Veritech supplies energy-related software and consulting services to process industries. For questions or comments on this article, contact him at 703-435-7885 or info@veritech-energy.com. ●

Letters to the Editor

Energy Matters welcomes your typewritten letters and e-mails. Please include your full name, address, organization, and phone number, and limit comments to 200 words. Address correspondence to:

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We publish letters of interest to readers on related topics, comments, or criticisms/corrections of a technical nature. Preference is given to articles that appeared in the previous two issues. Letters may be edited for length, clarity, and style. ●

Energy Matters EXTRA

Check Energy Matters Extra for more on system integration. Two OIT fact sheets describe cutting-edge control technologies that could lead to improved productivity, product quality, and cost and energy savings for industry. Find out about wireless telemetry architecture technology being developed to provide building blocks for intelligent industrial process control systems. Also learn about flame image analysis that will allow aluminum manufacturers to capture video images and other information for optimal control of natural gas-fired furnaces.

In addition, two articles from *Plant Services* magazine present valuable ideas on managing plant processes. The first explores the issues to consider when upgrading an older control system. The second discusses the importance of managing the knowledge necessary to design, build, operate, and maintain a plant.

You'll also find details on upcoming compressed air training classes cosponsored by the Compressed Air Challenge® and the Iowa Energy Center at Iowa State University. And link to the seven new BestPractices Energy Tips Sheets discussed above.

Log on to Energy Matters Extra at **www.oit.doe.gov/bestpractices/explore_library/emextra**. ●

Coming Events

Compressed Air Challenge Training Programs

- May 8, 2001, in Ames, IA, (Part I, Fundamentals)
- May 9-10, 2001, in Ames, IA (Part II, Advanced Management)
- May 22, 2001, in Cedar Rapids, IA (Part I, Fundamentals)
- May 23-24, 2001, in Cedar Rapids, IA (Part II, Advanced Management)

For more information, please log on to **www.oit.doe.gov/bestpractices/take_class/calendar.shtml**.

Spirax Sarco/AEE Energy Efficiency Exposition and Workshop

- May 9-10, in San Diego, CA
- August 24-26, in Atlanta, GA

For more information, please log on to **www.aeecenter.org/shows/**.

ACEEE Summer Study on Energy Efficiency in Industry

- July 24-27, 2001, in Tarrytown, NY

For more information, please call the American Council for an Energy-Efficient Economy (ACEEE) at 202-429-8873.

Integrated Energy Efficiency Congress/Facilities Management and Maintenance Expo

- August 29-30, 2001, in Cleveland, OH

For more information, please log on to **www.aeecenter.org/shows/**.

Energy and Environmental Technologies Conference

- October 16-17, 2001, in Atlantic City, NJ

For more information, please log on to **www.eetech.org**, or call 609-499-3600, extension 3.

Coming Next Issue:
The next issue of Energy Matters *focuses on the volatile energy market, with discussion on the implications for industrial users, solutions, and actions.*

*To keep up-to-date on OIT training and other events, check the calendar regularly on Energy Matters Extra at **www.oit.doe.gov/bestpractices/explore_library/emextra.***

BestPractices

The Office of Industrial Technologies (OIT) BestPractices initiative and its *Energy Matters* newsletter introduces industrial end users to emerging technologies and well-proven, cost-saving opportunities in motor, steam, compressed air, and other plant-wide systems. For overview information and to keep current on what is happening office wide, check out the newsletter—The OIT Times—at **www.oit.doe.gov/oit-times**.

Information Clearinghouse

Do you have questions about using energy-efficient process and utility systems in your industrial facility? Call the OIT Information Clearinghouse for answers, Monday through Friday 9:00 a.m. to 8:00 p.m. (EST).

HOTLINE: 800-862-2086

Fax: 360-586-8303, or access our homepage at www.oit.doe.gov/clearinghouse.

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